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ABSTRACT

The utility of computer based on-line retrieval of material from the ERIC document files was tested by members of the ERIC Clearinghouse on Educational Media and Technology at Stanford University and by the Region IX office of the U.S. Office of Education in San Francisco. The DIALOG retrieval system developed by the Information Sciences Group of the Lockheed Palo Alto Research Laboratory was the on-line system tested. More than 800 searches were conducted and over 51,000 citations and abstracts were printed in the 1-year period covered by this report. A short discussion of the implementation of the system, as well as summaries of the evaluations that were conducted at Stanford and San Francisco are included. The system was used principally for retrospective retrieval and for generation of special bibliographies. Users were most impressed by the speed and "horizon widening" effects of the system, and nearly all were satisfied with search results. Based on a predictable potential demand with a low of 10,000 and a high of 125,000 requests per year, a general discussion of benefits which would accrue from the routine use of DIALOG concludes the report. (MT)

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FINAL REPORT

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ERIC ONLINE RETRIEVAL SYSTEM – USE OF THE DIALOG ONLINE INFORMATION RETRIEVAL SYSTEM WITH ERIC RESEARCH IN EDUCATION FILES

April 1970

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
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USE OF THE DIALOG ONLINE INFORMATION RETRIEVAL SYSTEM WITH ERIC RESEARCH IN EDUCATION FILES

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April 1970

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Section 1

INTRODUCTION

Summary

The utility of computer-based online information retrieval with the ERIC Research In Education files was tested by members of the ERIC Clearinghouse at Stanford University and by the Regional Office of Education at San Francisco. Using a display-oriented retrieval system called DIALOG, which was developed by the Information Sciences organization of the Lockheed Palo Alto Research Laboratory, ERIC personnel conducted more than 800 searches and printed out more than 51,000 citations and abstracts over a 1-year period.

Evaluations of the system were conducted at both locations. Users were most impressed by the speed with which answers to search questions could be obtained, and by the way visual interaction with the file via the display terminal significantly extended their search horizons. Nearly all users (90%) were satisfied with search results. Particularly useful system features were felt to be the display and the typewriter scratch-pad record that accompanies the search process.

The system was used principally for retrospective retrieval and for generation of special bibliographies, an example of which is included in Section 4. Estimates of potential demand for use of the system range from 10,000 to 125,000 requests per year. Examples of additional uses of the system include current-awareness announcements and evaluation of requests for grants.

While not readily measurable in a quantitative sense, the principal benefit that the system provides is the capability to quickly access reported information so that the researcher can effectively accumulate up-to-date knowledge within his profession.

Introduction

The information explosion of the past decade has been accompanied by a proliferation of techniques to assist in information retrieval. Most familiar are the published catalogs of bibliographies and descriptive abstracts frequently organized by subject and cross-referenced by author, contract number, corporate source, etc. These catalogs are widely disseminated and serve both announcement and retrieval source roles.

Equally interesting has been the development of computer-oriented information retrieval systems. Recently it has become possible to store the catalog in a central computer and provide access to the computer using television-like keyboard display devices, which, in many cases, are connected to the computer via ordinary telephone lines. The user is provided a set of command keys on his terminal keyboard with which he can instruct the computer to search for abstracts containing any desired combination of characteristics. Having reviewed the results of one query, he may then modify his question to further refine the

query or to branch off onto some interesting related topic. At any time during the course of the search session, the user may print out particular items of interest or even complete bibliographies.

In the subject contract, Office of Education personnel were provided with use of a state-of-the-art information retrieval language that has been applied to Research in Education and Historical Reports data bases. The language, known as DIALOG,* was developed by the Information Sciences group of the Lockheed Palo Alto Research Laboratory. (See Appendix A for a reprint of the Users Manual, which describes the system in detail.) Remote terminals were installed at the ERIC Clearinghouse on Educational Media and Technology at Stanford University, at the Office of Education Regional Office in San Francisco, and at ERIC Headquarters in Washington, D. C. Office of Education personnel and others had conducted interactive searches on the ERIC data bases for a period of just over a year at the time this report was prepared.

A description of the experiment, analysis of the results, and conclusions in terms of potential demand and expected benefits are presented in this report. The remainder of this section outlines the work performed and the methods used. Section 2 discusses the findings and analysis, Section 3 presents conclusions, and Section 4 contains cited references and a bibliography. The appendixes contain the ERIC/DIALOG Users Manual, examples of invitation letters sent out from centers, and a detailed summary of search results.

Methods

The work performed in this research included loading ERIC files onto the Lockheed computer; installation of remote terminals at Stanford, San Francisco, and Washington, D. C.; and provision of a computer retrieval service to those terminals for scheduled operating periods. In addition, an evaluation of a computer-controlled microfilm display system was conducted, and a continuous 3-day presentation at the annual meeting of the California Association of Secondary School Administrators (CASSA) was given.

In early 1969, computer magnetic tapes containing 12,300 bibliographies and descriptive abstracts from Research in Education and Historical Reports files were loaded onto random-access computer storage devices at the Lockheed computer center. Index and cross-reference files were created from fields in the master records based on discussion with ERIC personnel (see Appendix A, pp. 13–14, for examples of input records and field indexing).

A remote terminal consisting of an IBM 2260 display and a 1053 printer (see Appendix A, p. 2) was installed at the ERIC Clearinghouse on Educational Media and Technology at Stanford University. This terminal was coupled to the Lockheed computer via a Bell 201 data set with a transmission rate of 240 characters per second. Clearinghouse personnel conducted interactive searches using the terminal in response to mail and telephone requests from the education community. In

*A later version developed for NASA is known as RECON, an acronym for Remote Console.

addition, an invitation (Appendix B) was mailed to local educators to enable them to become familiar with the service. Based on their experience with the terminal, Stanford published a report evaluating the system operation (Ref. 1), which is discussed in Section 2.

In third quarter of 1969, the file was updated through August 1969. File size at this time included approximately 20,000 titles. A thesaurus file was added through which users could obtain conceptually related index terms on the display terminal. A later version of DIALOG was installed that provided some additional conveniences to users. A second remote terminal (CC30, manufactured by Computer Communications, Inc.) was installed at the Office of Education Regional Office in San Francisco. This terminal, although functionally similar to that installed at Stanford, was considerably more economical in both lease and operating costs and in the physical size of support equipment.* This terminal utilizes a Bell 202 data set with a transmission rate of 120 characters per second.

In parallel with the service operations at Stanford and San Francisco, an interesting experiment was conducted with a small microfilm company, Microform Data Systems, Inc. A sample of 2,000 of the ERIC abstracts was reduced to microfilm and placed on a computer-driven M.D.S. viewer. In this environment, the user could conduct a search of the indexes residing in the computer to identify candidate abstracts. Any abstract could then be displayed on the viewer with a simple command to the computer. This configuration was demonstrated at the 1969 Fall Joint Computer Conference in Las Vegas.

In late 1969, a final terminal, identical to that in San Francisco, was installed at ERIC headquarters in Washington, D.C. This terminal is part of an Educational Information Center project.

In April 1969, the San Francisco terminal was temporarily relocated to San Diego for the annual Conference of the California Association of Secondary School Administrators. During the conference a large number of searches were conducted by attendees with results mailed directly to their homes to await their return.

A sample listing of search titles is provided in Appendix C to illustrate the variety of topics of current interest within education and to demonstrate the practical operational nature of online retrieval methods.

Summary of Usage Statistics

Usage statistics are summarized in this section for Stanford, San Francisco, and San Diego (California Association of Secondary School Administrators Conference). Detailed frequency distributions appear in Appendix C. Characteristics measured include elapsed time per search session (Table C-1), number of online references to the thesaurus (Table C-2), number of index terms per search session (Table C-3), number of items** displayed (Table C-4), and number of items printed (Table C-5). Table 1-1 summarizes overall usage.

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*These differences are discussed in greater detail in Appendix C.

**An "item" consists of a bibliographic citation and descriptive abstract describing a single report or document.

Table 1-1

SUMMARY OF TOTAL OVERALL USAGE

Terminal	Operation Time	Number of Searches	Number of Items Printed
Stanford	7 months	338	30,970
San Francisco	7 months	453	20,111
San Diego	2 days	40	1,200

As Table 1-1 indicates, in 7 months of operation nearly 1,000 searches were conducted and more than 51,000 items were printed in response to the searches. This volume is equivalent to that of republishing 3 years' issues of the R.I.E. (Research in Education) announcement catalog twice over. In this case, however, items were developed in response to specific inquiries.

Table 1-2 is a summary of individual search characteristics for Stanford, San Francisco, and San Diego.

Table 1-2

SUMMARY OF AVERAGE STATISTICS PER SEARCH

Terminal	Elapsed Time (min)	Thesaurus References	Index Terms	Items Displayed	Items Printed
Stanford	23.7	6.4	15.0	3.4	91.7
San Francisco	19.8	9.5	21.9	5.8	44.3
San Diego	16.3	8.9	15.1	5.9	30.4

The differences shown in Table 1-2 among the various locations are probably not particularly important. Stanford, for example, provided more in-depth instruction and demonstration than either of the other two, which perhaps accounts for the longer elapsed search time. It should also be remembered that "search" is defined not as a single question but rather as a single session with a particular user. Frequently, several related questions are formulated during the course of a single search session.

Section 2

FINDINGS AND ANALYSIS

This section contains evaluations of ERIC/DIALOG use at the ERIC Clearinghouse on Educational Media and Technology at Stanford University, and at the Region IX Office of Education in San Francisco. No formal evaluation was carried out for the San Diego Conference installation.

Evaluation of Stanford Results*

The ERIC Clearinghouse on Educational Media and Technology at Stanford University was asked by the U.S. Office of Education to help evaluate online computer searching of the ERIC document file. A terminal with its supporting equipment was installed in the Clearinghouse, and arrangements were made for data-phone linkage with Lockheed's nearby Information Sciences facilities, where the DIALOG system was available.

DIALOG was to be used to accomplish Clearinghouse tasks – both those usually performed and those impossible without such a system – and to see whether individuals could sit down at a terminal and, with little preliminary instruction, use such a system to locate relevant educational research documents. The system was employed in a variety of Clearinghouse projects and proved extremely useful. Nine case studies were conducted, and 19 questionnaires were solicited, which reveal in some detail the reactions of the individuals (who had quite different backgrounds and sought quite different information) to 2-hour "hands-on" sessions at the terminal.

The case studies demonstrate that individuals with no preliminary experience with computers or mechanized information systems can, indeed, in a reasonably short time, use a system such as DIALOG effectively.

The two aspects of the system that most impressed the nine evaluators were its speed and the way it "widened horizons," i.e., the way it suggested other relevant areas of information or different approaches to the information originally sought.

When the evaluators were specifically asked to list "good" features of the system, its speed and its "horizon-widening" effect were mentioned. Also cited were the way in which sets of documents could be combined, using Boolean logic, and the fact that the system was simple to use.

The evaluators also were specifically asked to list "bad" features. Delays in waiting for the system to execute a command were singled out, along with the feeling that considerable experience or time was needed to master the operating rules. (While some evaluators made this last comment, others called the system simple

*This subsection is extracted from Ref. 1 (which is recommended as a more complete analysis and evaluation).

to use and easy to work with.) Users were asked to comment on each component of the system, such as the typed terminal record and the cathode ray tube display. The terminal record was appreciated as a means of monitoring the ongoing search and as a way of obtaining a permanent record of search strategy. The cathode ray tube was cited as saving great amounts of time and as being a natural way to present data. There was criticism of some components, or of their integration in the system. A number of users wished that commands could be entered without having to hit so many keys. The project coordinator registered concern over problems with hardware and software that caused interruptions in scheduled service. Changes that have been made in DIALOG since the evaluation sessions have obviated some of the unfavorable comments.

Seven of the nine evaluators reported that they asked additional and different questions about the subject they originally were investigating, and seven – although not the same seven – said that they came upon material on different, though related, subjects that they would like to pursue at a later date.

Verbatim statements are presented here to demonstrate user reaction to this aspect of the system:

A I began to realize they had some articles of international scope ... [and that] kind of opened up that area ....

C Well, as we began to look at the section on instructional television, there were some related topics there that I hadn't been aware of .... There were a couple of topics that interested me, one in the area of teacher training, which I just happened to run across, but I would like to look into at another time, although it wasn't particularly related to this study.

D The only thing I formulated was new areas to look under for relevant research.

E Let me tell you some questions that were answered that I posed to myself, and were answered during the process .... New questions that are already answered .... I stumbled on something, again because there are some things that are not in the thesaurus but are in DIALOG [identifiers]. I stumbled onto [specific] programing languages.

H ... The biggest problem was staying with what I had originally pursued, instead of getting off on other interesting things.

I I did run across some other information [that I would want to pursue later] .... We've got our mind on one thing, particularly when we're researching something, one phase, and we only think to look in certain areas, and the thing that I liked about this, the machine points out that there may be some other related information .... This is, I think, very significant, and very helpful.

We assume that such "horizon-widening" effects are extremely desirable, and we can imagine no research administrator with such a narrow area of concern as to object to this aspect of DIALOG. To look at the situation from a different viewpoint, this aspect tends to bring the useful documents in the collection to the user's attention even though his preconceived ideas of what is available are incorrect.

Six of the evaluators had favorable comments on the way the system made it possible to monitor and modify searches, but the other three should not be considered negative or indifferent. Most of the evaluators had no previous experience with computerized retrieval systems, and so could hardly compare DIALOG with non-interactive, batch-processing systems. Our feeling was that the evaluators reacted to DIALOG as an entity, and that the overwhelmingly favorable general comments were to a great extent the result of this very basic aspect of the system.

The individual verbatim statements were as follows:

A It makes a big difference, because you get a feeling of control over your search that you don't have so much when you're actually in the library. There, it's hard to remember exactly which things you were going to go back and do – you have to write things down, you have to organize things. Here you have handy little systems for putting something off somewhere and you just organize in your own mind the very basic concepts.

B It has a much more organizing effect, it helps to organize in a much more effective way.

C It helped me .... I think the fundamental help was that I had some idea of the amount of information I was handling, or would be handling, if I had it printed out. And it gave me some insight, too, into the amount of research that had gone on in certain areas.

D It's like having a great mass of information at your disposal, where you can somehow set up and know where you are and how much you've looked at.

F I think it made a great difference.

I It gives you other ideas and other, related, sources.

After the nine intensive case studies had been completed, the retrieval system was used to conduct searches requested by visitors to the Clearinghouse. The observations and reactions by 19 of those visitors were recorded on six-page questionnaires that paralleled, to a great extent, the "debriefing outline" used in the nine case studies. By the time the first of the 19 visitors arrived on the scene, the previously discussed modification of programing had been completed, and it was DIALOG II, rather than the original system, that was observed.

There were no striking differences between the responses recorded on questionnaires by the 19 and the tape-recorded comments of the nine case study participants. One question on the questionnaire, however, had not been put to the nine evaluators:

> If DIALOG were readily available to you at a convenient location, how often would you like to use it?

All 18 visitors who answered this question indicated that they would like to use such a system several times a year or oftener. A third of the visitors indicated that they would like to use it once a week or oftener. The number giving each answer is shown below:

never	once a year	several times a year	once a month	once a week	more often than once a week
0	0	6	6	4	2

About half the visitors (8 of 18) indicated that the system revealed new aspects or dimensions of the subject to them, and about half (10 of 19) reported coming upon material on an entirely different subject that they then wished to pursue.

The 19 visitors were asked to indicate what they considered good and bad features of the system. A total of 65 good features and 16 bad features were listed. No novel comments not included in the earlier remarks of the nine evaluators were made.

When prompted to evaluate specific features of the DIALOG system, the ratings were uniformly favorable. The ratings are presented here for the sake of completeness. Each scale is presented as a continuum, running from the descriptive term presented at the left to that at the right. The number of visitors checking each point on the scale is indicated:

The Keyboard

easy to use	6	6	4	2	0	difficult to use

The Typed Terminal Record

easy to use	6	9	3	0	0	difficult to use
valuable in conducting a search	17	0	0	1	0	not valuable

The CRT or Visual Display

easy to use	10	6	0	1	0	difficult to use
valuable in conducting a search	18	0	0	0	0	not valuable

The Thesaurus

easy to use	8	2	3	0	0	difficult to use
valuable in conducting a search	7	4	2	0	0	not valuable

In addition to the nine case studies presented in this report, some other observations on DIALOG appear as a product of its application to a variety of tasks in the Clearinghouse. These applications can be categorized as duplicate checking, in-house projects, answers to information requests, and visitor use. The actual experience gained from using DIALOG for these purposes has bearing on any future computerization of the ERIC files.

Duplicate checking, for example, is an extremely time-consuming process which, in the past, has involved manually checking each acquisitioned document against the current acquisition data log and all past indexes. DIALOG has made it possible for the staff member in charge of this processing to perform the checking more quickly and with greater assurance of not missing a document. The only requirement for this is that the file be as current as possible. A real improvement would be the ability to access the acquisition data log on the CRT, thereby streamlining the process still further.

A spin off of the system is a "dump" of the indexes. This listing makes it possible to perform routine checking at any time, saving online processing for the especially difficult documents. Again, for this to be continuously effective, it would be necessary to keep the listing updated. This listing also has value as a record of the number of relevant entries in the file on any given attribute, which makes it possible to check the size and scope of any search before actually using the online terminal.

The in-house aspect of DIALOG use is similar to visitor use in that the system can be used to obtain extensive bibliographies on any subject being considered for a locally produced bibliography or state-of-the-art paper, as well as to conduct literature searches to support other projects being undertaken by a clearinghouse. Three clearinghouses (in addition to ERIC at Stanford) have made use of this facility to produce long bibliographies for various projects. It has also been used

to produce supporting bibliographies for clearinghouse-affiliated people working on a project of the Institute for Educational Development, evaluating the impact of Title VII research. Thus, clearinghouse activities related to analysis of information in the clearinghouse's specialty area are greatly assisted by the online search capability.

The load of quite specific informational requests that flow into the Stanford Clearinghouse (approximately 40 per month) can also be handled more effectively by using DIALOG. While it was in operation, the Clearinghouse staff used DIALOG to handle 93 of these requests in depth. Without the online facility, it would have been impossible to give each of these users an exhaustive bibliography. Instead, the requests would have been handled in a general way, perhaps by giving the person information on where he might start his search or who might be able to help him. DIALOG made it possible to give the requested listings of things already processed by ERIC that conformed to his particular interests. Feedback from people receiving this service indicates that it was extremely useful and greatly appreciated. An offshoot of handling these requests was a compilation of the duplicates of past searches; these can be used to answer subsequent similar requests without using additional computer time.

Finally, and most importantly, DIALOG proved valuable to Clearinghouse visitors. Through October 31, 46 people had been given a demonstration and introduction to the system; 68 people had their requests searched by a staff member while they were present to interact with the system, modifying the search strategy as necessary; and 21 people (including the nine evaluators) were taught to use the system and gained "hands-on" experience. Individuals who thus used the Clearinghouse as a source of ERIC materials were able to perform their literature searches efficiently.

Perhaps the most important aspect of DIALOG is the ease of use of the system. For people who are unfamiliar with computers and who have a limited amount of time to devote to their own professional research and even less to learning to use a new research technique – no matter how powerful it may be – it is essential that the technique be simple to understand. Experience in demonstrating the DIALOG system and in instructing people in its use indicates that the system is indeed simple and does not overwhelm a person who is unfamiliar with computers. The instruction did require some staff time to teach people on an individual basis, but it is clear that the process could be made basically self-instructional through development of some simple materials and a film or slide presentation. A minimal amount of staff time would be required to monitor the first use of the system until the user was proficient.

Evaluation of Region IX Results (San Francisco)

The Office of Education Region IX Office, located in San Francisco, conducted searches for a variety of users, including representatives from several professional categories and geographical regions. A report is planned by the Regional Office analyzing this activity; some of the statistics and questionnaires from users have been made available by this office for inclusion in this report.

Professional categories of terminal users are listed in Table 2-1.

Table 2-1

PROFESSIONAL CATEGORIES OF TERMINAL USERS

Category	Percent of Total
Teachers	38.0
Researchers	24.0
Government Personnel	17.0
Administrators	10.0
Private Citizens	9.0
Librarians	2.0
Total	100.0

As shown in Table 2-1, more than half of the user group were teachers or researchers. Within the teacher group, nearly two-thirds were elementary or secondary teachers, and one-third were teachers from higher education institutions. Government personnel included users from federal, state, and local education organizations. Administrators included executive director-level personnel, irrespective of organization. Although these categories are not mutually exclusive, they were chosen to indicate the breadth of appeal of such retrieval.

Table 2-2 shows the geographic distribution of system users.

Table 2-2

GEOGRAPHICAL DISTRIBUTION OF TERMINAL USERS

State	Percent of Total
California	89.0
Washington	3.0
Kansas	2.0
Oregon	2.0
Other	4.0
Total	100.0

Clearly, most users were from California. Users in the "Other" category include Hawaii (3 users), Nevada (2 users), Alaska (1 user), and Washington, D.C. (1 user).

In this study, 300 searches were conducted. Although most users (86%) conducted a single search, several (24%) conducted more than one search, as indicated in Table 2-3.

Table 2-3

TABULATION OF NUMBER OF SEARCHES PER USER

Number of Searches per User	Percent of Total
1	86.0
2	8.0
3	2.0
4	2.0
5 – 8	2.0
Total	100.0

Post-use questionnaires were sent to individuals participating in the study. The questionnaires surveyed a variety of user-reaction areas, including: whether the original search question was answered, what good features were observed, what poor or awkward features were observed, whether the display (as compared with a typewriter) was helpful, and whether or not the ERIC Thesaurus was useful. Table 2-4 summarizes the results of the data obtained from the questionnaire.

Table 2-4

SUMMARY OF QUESTIONNAIRE RESPONSES FROM OFFICE OF EDUCATION REGION IX OFFICE

Questions and Replies	Percent of Total Replies
1. Were original search questions answered?	
Yes	90.0
No	10.0
	100.0
2. What good features impressed you most?	
Speed	30.5
Ability to coordinate concepts	15.0
Time saving over conventional methods	13.5
Completeness of results	13.0
Ability and knowledge of search coordinator	11.0
Interactive capability of system	8.5
Convenience and simplicity of system	8.5
	100.0
3. What features did you find poor or awkward?	
None	30.8
Inadequate subject coverage or indexing	18.5
Training required to use system	15.4
More time desired at terminal	10.5
Time delays and system failures	9.2
Need for more information on document sources	9.2
System should be more widely available	6.4
	100.0

Table 2-4 (Cont.)

Questions and Replies	Percent of Total Replies
4. What was your reaction to the visual display?	
It helped substantially	97.0
It was not too helpful	3.0
	100.0
5. How helpful did you find the published ERIC Thesaurus?	
Extremely helpful	37.5
Moderately helpful	51.5
Not too helpful	11.0
	100.0

It should be noted that replies to questions 2 and 3 were unprompted. The summary replies listed in Table 2-4 represent a somewhat gross characterization of the actual comments received. Several of the actual comments are presented below for illustration:

> When you're up a blind alley you can branch out without wasting time. [The system] could completely eliminate useless research and duplication of effort. (Librarian)

> Not only were original questions answered, but so were the subquestions which the search helped formulate. (Resource teacher)

> Our schools must change. The proposed changes must be built on truth. The retrieval of researched areas of education for change construction is critical. (Teacher)

> System coverage should be expanded and made generally available, as it is the only way ERIC materials will get wide distribution and use. (Teacher)

> Without the computer, I would have ignored ERIC as a source of data because of the difficulty of using R.I.E. (Teacher)

> I found dozens of papers I was previously unaware of even though I carefully check the monthly issues of R.I.E. (College Administrator)

> Undoubtedly ERIC would be used much more often if this system were generally available. (Program Director)

> It is a fantastic system; how long education has needed it! (Coordinator)

> I am so greatly impressed with the system that I can only hope that it will be maintained and expanded, including the availability of terminals on each college campus. (College Administrator)

Fantastic; in 22 minutes I accomplished what would have required 10 hours if done in a traditional manner. (Teacher)

As the volume of ERIC materials increases, it will be imperative that this system be made available to all users. (Director of Research)

I was delighted with the results of my first search. It will save me dozens of hours and will allow me to produce teaching and research materials that might otherwise be impossible because of time constraints. (College teacher)

It would have taken at least 2 months using ordinary library research methods to obtain such concise, pertinent information. (College President)

To summarize the results of the Regional Office usage, response to the DIALOG online retrieval system with the ERIC files was unanimously enthusiastic. Of the users who indicated their search questions had been answered (90%), many were surprised at the speed of the system and at the completeness of the results. Those users who indicated that their question had not been answered (10%) usually commented that R.I.E. did not include material pertinent to their particular query. Speed was offered as the most favorable feature of the system, followed by the ability to coordinate concepts to form intersections of the data base. Negative comments referred to the data base in 28% of the cases, and to the retrieval system in 25% of the cases. Thirty-one percent of respondents could think of no negative features, and 17% indicated that they desired more time on the system or that the system should be more widely available. Almost all users (97%) indicated that the visual display helped substantially, as compared with a typewriter-only terminal, and most users (90%) found the Thesaurus at least moderately helpful.

Comments suggest that use of ERIC materials (R.I.E. in this case) could be substantially increased through general use of the DIALOG online retrieval system. During the period of this report, more than 50,000 citations and abstracts were printed in response to specific requests. This volume is equivalent to the entire collection being republished twice.

Two quantitative estimates of time savings were given: 10 hours, and 2 months. Even the lower figure results in an effectiveness/cost ratio of more than 16:1, indicating that, in this case, online retrieval is not only convenient but also cost effective.

Many other comments were directed at the skill and understanding of the system coordinator, Mrs. Katherine Alderfer. Her role in introducing the system and guiding the searches elicited a highly favorable reaction among users.

Section 3

CONCLUSIONS

Because of the vast amount of information available and the ever-changing needs of the information user, it is necessary to "package" information in a variety of forms and to organize it along several dimensions. Moreover, because the individual who is a source of information can at best only anticipate the gross, rather than the specific, needs of the user, and because the information user does not know the magnitude of the potential supply of data in the information collection, it is necessary to provide the user with a tool that will allow him to explore – and gain rapport with – the information collection. Online information retrieval, as characterized by the DIALOG system, provides such a tool. It enables the user to dynamically partition the total information collection according to user-specified combinations of characteristics. As the user becomes familiar with the potential of the file to satisfy his data needs, he can modify his specification to explore items in related areas of interest.

The effectiveness of such a tool is theoretically measured in terms of the degree to which the tool allows the user to identify a maximum number of relevant file items with a minimum number of irrelevant items.

The usefulness of this measure is somewhat limited with regard to large, practical (as opposed to experimental) information stores. Measurement of whether all relevant items have been retrieved implies exhaustive examination of the file. In addition, the above measure fails to consider the extent to which the system assists the user in formulating his query or the extent to which the system "widens the horizons" of the original search topic. In the final analysis, the effectiveness of an information retrieval system depends jointly on the usefulness of the information base and the ease with which a user can obtain the needed information.

The conclusions presented in the remainder of this section are organized as follows:

- User satisfaction
- Potential demand
- Expected benefits

Discussion within each of these topics is largely synthesized on the basis of previously presented material.

User Satisfaction

An overwhelming majority (90%) of users were satisfied with the search results obtained by using the DIALOG system. Of those users who indicated that they were not satisfied (10%), most felt that the information they were seeking was not in the file. Several of the unsatisfied questions pertained to statistical or cost studies on various special programs.

System components (keyboard, typed terminal record, and display) were found easy to moderately easy to use by 94% of the users questioned, and none found them difficult to use. Of those who experienced some difficulty (6%), most had difficulty with the keyboard device.

A high degree of usefulness was attributed to the display (100% at Stanford and 97% at San Francisco). In addition, 95% of Stanford users found the typed terminal record very useful (this question was not asked at San Francisco).

The concensus in favor of the display deserves further comment. The principal advantage is not that of the presentation medium (i.e., display versus typewriter), but rather the presentation content. Because of the slow speed of the typewriter (15 to 30 characters per second) compared with the display (120 to 240 characters per second), it is simply impossible to transfer information from the computer as fast as the user can assimilate it using only a typewriter device. The result is that most typewriter-oriented retrieval systems neither provide the user access to the indexing dictionary (or thesaurus), nor do they display full citations and/or abstracts to assist the user in better defining his search question.

The mere use of a display in no way assures that a system provides the useful features discussed in the preceding paragraphs. Many typewriter-oriented systems merely substitute a display for the typewriter, adding no additional information-transfer capability. The critical questions seem to be whether the system provides sufficient information flow from the file to the user to enable him to evaluate and, if desired, to modify his search question in a truly interactive mode. In this case, a simbiosis between man and machine can occur to the material benefit of each.* Otherwise, the only advantage of "being online" to a computer is that the information needs can be satisfied faster.**

Potential Demand

The Stanford report indicates that the Stanford Clearinghouse receives approximately 40 reference questions per month. Assuming 20 reference centers (19 clearinghouses and a central Washington information center), each of which experiences this level of demand, a total of approximately 10,000 requests per year are received. This demand level – and it is probably understated – could be fulfilled by one experienced operator using the DIALOG system.

A different estimate of demand was offered by the Stanford study, which indicated that two-thirds of the individuals questioned would use the terminal at least once per month. The expected level of usage based on the replies of this sample is 25 queries per user per year. In 1968, there were more than 5,000 subscribers to R.I.E. If only one system user per subscriber is assumed, this would result in 125,000 requests, or approximately 6,250 per reference center. Such a demand would justify a part-time operator at each of 20 reference centers, or 12 full-time operators at a central center.

*More relevant results for the user, less printing for the computer.

**Many computer people unacquainted with the benefits of true interaction argue that faster response time is the only benefit of an online – as opposed to an offline – system.

Expected Benefits

An information retrieval system coupled to an ever-expanding data base can provide three types of services:

- Retrospective retrieval – identification of a subset of abstracts that are relevant to particular detailed questions
- Special bibliographies – production of searches of wide interest, the results of which are published and distributed
- Current awareness – periodic notification provided to special-interest groups of current abstracts in their areas of interest

Of the three types of services, this report considers the retrospective-retrieval use of the system in greatest detail. Reference 1 describes several special bibliographies* developed by other clearinghouses and by staff members in support of other projects. The current-awareness service arises as a byproduct of DIALOG. That is, any user requesting a search can ask that he continue to be informed of future abstracts that fall into his search request areas. In this case, his search expression is retained and processed against each update of the file to keep the user informed and up to date on his particular topic of interest. The result of this combination of services is that subscribers are continually informed on topics of interest to them with minimum inconvenience. Documented results of these services based on experience reported elsewhere (Ref. 2) show a substantial increase in the demand for documents announced within the ERIC system. One can expect increased demand in both currently and previously announced documents. It is the expanded dissemination of documents, together with the greater use of educational research that expanded distribution implies, that indicates the direct effectiveness of the retrieval system.

An indirect benefit to the Office of Education would accrue through use of the system to evaluate the novelty of requests for grants. Review of a given data base by the grant evaluator would require that the requestor show that his investigation did not merley duplicate some previous research. If requestors were made aware of such a review procedure, they would be more inclined to use the system to review the state-of-the-art in their area of interest before developing a research project.**

Ultimately, the easy availability of an ERIC/DIALOG system allows greater normalization among members of the education profession in terms of information and access to research results. Consequently, the professional researcher who avails himself of the system is freed to pursue his own interests to a greater degree based on a foundation of familiarity with what others in the profession have reported. Without an effective information retrieval and dissemination system, the accumulation of knowledge within a given discipline is severely constrained. Beyond the measures of the abstracts printed and the documents distributed, it is undoubtedly the machinery for quick and efficient accumulation of knowledge that is the most significant benefit to be derived from the system reported herein.

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*One bibliography evaluating the impact of Title VII research contained several hundred items.

**Actual evidence of this process has been noted in the searches performed by some researchers.

Section 4

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/AUTOMATION/ CLASSIFICATION/*DISPLAY SYSTEMS/ IN
DEXES (LOCATERS)/*INFORMATION PROCESSING/*INFORMAT
ION RETRIEVAL/ INFORMATION SYSTEMS/*TIME SHARING
/BIBLIOGRAPHIC ON-LINE DISPLAY/ BOLD/ CLASSIFICA
TION *INFORMATION PROCESSING/*DISPLAY UNITS (COMPU
TERS)/ INDEXES (LOCATORS)/ TELETYPEWRITER

Appendix A

ERIC/DIALOG USERS MANUAL

USERS MANUAL
ERIC/DIALOG ONLINE
RETRIEVAL SYSTEM

Stanford University

N-6R-69-2 May 1969

Developed by:
Information Sciences Laboratory
Lockheed Palo Alto Research Laboratory
LOCKHEED MISSILES & SPACE COMPANY
A Group Division of Lockheed Aircraft Corporation
Palo Alto, California 94304

FOREWORD

Project DIALOG is the culmination of 6 years of research in information storage and retrieval conducted by the Information Sciences group of the Lockheed Palo Alto Research Laboratory. The DIALOG system offers the user an interactive command language with which he can direct the data processing power of a computer to assist him in the retrieval of information. The current version has evolved from the operational experience of several data bases, and has proved both easy to operate and powerful in results.

By eliminating intermediaries and placing the user in direct communication with the computer, results are available in seconds or minutes instead of days or weeks, and interesting avenues of exploration suggested by preliminary results can be pursued without time lapse. DIALOG commands provide means for describing a search interest to the computer, for obtaining displays (and printouts) of results, and for redefining a search interest based on examination of intermediate results. By dynamically partitioning the information store, the user can rapidly and efficiently converge on a relevant set of documents.

In the current application, the DIALOG retrieval language is applied to the ERIC data base of some 15,000 report citations. A remote terminal has been installed in the ERIC Clearinghouse at Stanford University, W. J. Paisley, Director. Questions and/or comments regarding this project should be forwarded to J. J. Prevel, U.S. Office of Education, Department of Health, Education, and Welfare, Washington, D.C., Code 20202. Additional information regarding the DIALOG system can be obtained from R. K. Summit of the Lockheed Palo Alto Research Laboratory.

LOCKHEED PALO ALTO RESEARCH LABORATORY
LOCKHEED MISSILES & SPACE COMPANY
A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

Section 1
ERIC/DIALOG DESCRIPTION

DIALOG is an interactive information retrieval language which allows the user to formulate simple or complex search requests via a video/keyboard display terminal (Fig. 1) which is coupled to a computer containing the material to be searched. To use DIALOG, the user enters desired commands such as "begin search," "display," "select," or "combine" by depressing keys on the keyboard. The computer responds by displaying various data on the display screen.

Four important phases in the search are as follows:

- Select index terms or subject phrases
- Combine individual terms or phrases
- Display output
- Modify search expression

In the first step, the user identifies and selects index terms (i.e., subject phrases) of interest which relate to his search topic. The second step allows the user to build his own specialized subject heading during the search. At each step the user is informed of the number of documents which fulfill his specified search criteria. The third step, display of the output, allows the user to review references for relevancy, and to select additional terms to better express his search requirement. Once the desired literature references are displayed, the user can press the "print" key for a permanent record of the retrieved references, or can modify his search expression based on index terms used in displayed references.

To use the system, a searcher must learn the clerical procedure, and must learn to effectively utilize the functions performed by the commands. The remainder of this section describes the clerical procedure for command entry, and provides an annotated search example illustrating the commands and the associated computer responses. Sections 2 and 3 present detailed command descriptions and ERIC/DIALOG descriptor codes together with examples.

Fig. 1 Video Keyboard Display Terminal

Fig. 2 Display Keyboard

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COMMAND ENTRY

The user communicates every command by performing the following three steps:

1. Depress desired command key (while holding down the "SHIFT" key). The command symbol will immediately appear on the display screen.
2. Key in appropriate operand data. These data will appear on the screen following the command symbol. (Note: up to this point, an erroneous entry may be corrected by backspacing and typing over undesired data.)
3. Depress the ENTER key (while holding down "SHIFT"). This action signals the computer that the user has a message to transmit.

The computer reacts by reading and processing the command message. A reply will always return on console printer (which serves as a search log) and, depending on the command, on the display screen as well.

To select the index term (IT) "computers," for example, the following operations would be performed:

Step	Operation	Keyboard (See Fig. 2)
1	Depress (with SHIFT key):	SELECT term
2	Type in	IT/COMPUTERS
3	Depress (with SHIFT key):	ENTER

This entry sequence causes the following response to be typed out on the console printer (Fig. 1):

SET NO.	NO. IN SET	DESCRIPTION OF SET † (+ = OR, * = AND, - = NOT)
1	130	IT/COMPUTERS

In other words, the 130 items indexed by the index term "computer" are assigned a set number (i.e., "1") which can be used for referencing this group of items in later commands.

---

†Note: This heading information results from the BEGIN SEARCH command which is described in detail in Section 2.

ANNOTATED SEARCH EXAMPLE

Assume that the user is interested in "use of computers in information retrieval." His search strategy could be as shown in Fig. 3. The user first selects the index term "computers." Noting that 130 items are indexed by this term, he suspects that "information processing" may also have been used as an index term. Selecting this term creates Set 2 which contains 104 items. Because he is interested in either "computer" or "information processing" (as they apply to information retrieval), he logically sums these two sets into Set 3 with the command COMBINE 1+2 (where 1 and 2 refer to Sets 1 and 2, respectively, and + stands for OR). This set contains 213 items.

The user is interested in only those items of Set 3 which deal with information retrieval, so he selects the index term "information retrieval" which creates Set 4 with 119 items. To obtain the intersection of Sets 3 and 4 (those items referring to computers or information processing as well as information retrieval), he issues the command COMBINE 3*4 (where * stands for AND). The references in Set 5 are then displayed one at a time by successively depressing the ENTER key. (The eighth item of the set is illustrated.) The abstract for any displayed citation can be displayed by depressing DISPLAY and ENTER.

The reader should mentally practice these steps using Fig. 2 before attempting to do his own search to assure an understanding of clerical and logical procedures of a search.

Operation	User Enters	Typewriter Response		
		SET NO.	NO. IN SET	DESCRIPTION OF SET (+ = OR, * = AND, - = NOT)
Depress Key below: (SHIFT)	SELECT term			
Type in:	IT/COMPUTERS			
Depress: (SHIFT)	ENTER *	1	130	IT/COMPUTERS
Depress Key below: (SHIFT)	SELECT term			
Type in:	IT/INFORMATION PROCESSING	2	104	IT/INFORMATION PROCESSING
Depress Key below: (SHIFT)	COMBINE set description			
Type in:	1+2	3	213	1+2
Depress Key below: (SHIFT)	SELECT term			
Type in:	IT/INFORMATION RETRIEVAL	4	119	IT/INFORMATION RETRIEVAL
Depress Key below: (SHIFT)	COMBINE set description			
Type in:	3*4	5	47	(1+2)*4
Depress Key below: (SHIFT)	DISPLAY set/fmt/item			
Type in:	5			

DISPLAY 5/3/0

ED019694 OCT67 L2000306 NASA-CR-918

EVALUATION OF USER REACTIONS TO A PROTOTYPE ON-LINE INFORMATION RETRIEVAL SYST EM.

MEISTER, DAVID SULLIVAN, DENNIS J.

C8Q06300BUNKER-RAMO CORP., CANOGA PARK, CALIF.

DOCUMENT NOT AVAILABLE FROM EDRS.

/*INFORMATION RETRIEVAL/*MAN MACHINE SYSTEMS/*USE STUDIES/ AUTOMATION/ COMPUTE RS/ EVALUATION/ FEEDBACK/ INFORMATION NEEDS/ INFORMATION SYSTEMS/ INTERACTION/ I NTERVIEWS/ LIBRARIANS/ NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/ QUE STIONAIRES/ RECON/ SCIENTIFIC PERSONNEL/ TIME SHARING

ENTER NEXT COMMAND>

*ENTER must be depressed with each command entry to transmit the command message to the computer. This operation will not be shown with succeeding commands for the sake of brevity.

Fig. 3 Illustrative Search Procedure

SEARCH EXTENSION

Figure 4 contains the console typewriter record of an extension of the search just described. The first column contains a command "echo" (one per line) of commands entered (S- for SELECT, C for COMBINE, etc., as in Fig. 2), and associated operand data (e.g., IT/COMPUTERS).

```
SEARCH TITLE:  USE OF COMPUTERS IN INFORMATION RETRIEVAL
DATE:          02/26/69
REQUESTOR:     J.J.PREVEL, USOE

                          SET   NO. IN      DESCRIPTION OF SET
COMMAND-OPERAND(S)        NO.    SET        (+ = OR, * = AND, - = NOT)
------------------------  ----  ------     ------------------------------------------------------

S-IT/COMPUTERS             1      130      IT/COMPUTERS
E-IT/INFORMATION PR
S-E5                       2      104      IT/INFORMATION PROCESSING
C-1+2                      3      213      1+2
S-IT/INFORMATION RE        4      119      IT/INFORMATION RETRIEVAL
C-3*4                      5       47      (1+2)*4
D-5
S-IT/TIME SHARING          6       16      IT/TIME SHARING
C-5*6                      7        6      (1+2)*4*6
D-7
P-7
                                           1-6            ITEMS HAVE BEEN PRINTED.
T-7/1
                                           TYPE    7/1/1-6
EDO16414   EDO16499   EDO17283   EDO79090   EDO19094   EDO20748
```

Fig. 4 Typewriter Record Including Search Extension

It can be seen that after viewing some of the 47 references of Set 5, the user decided to restrict the search to those dealing with "time sharing." Selecting this term resulted in Set 6 containing 16 items. This set was then combined with Set 5 to produce 6 items. The user displayed a few of these items and, determining them to be relevant, caused them to be printed at the computer with a PRINT 7 command. The accession numbers were also desired. These were typed at the terminal by a TYPE 7/1 command (1 indicates an "accession numbers only" format). This search illustrates a single procedure for identifying the relevant subset of items from a reference corpus. In actuality, there are several additional features available which are described in Section 2. Also, there is a variety of descriptor types which may be used in parallel fashion to IT/-index term. These include AU/-author, PS/-primary source, CN/-contract number, etc., which are described in Section 3.

SUMMARY OF DISPLAYABLE COMMAND RESULTS

Two commands, EXPAND and DISPLAY, result in displays. These commands are illustrated in summary. Operand data are shown in quotation marks and it is presumed that ENTER is depressed at the conclusion of command entry (as discussed on page 3).

Command message: EXPAND "IT/INFORMATION PROCESSING"

Result:

```
                    EXPAND-IT/INFORMATION PROCESSING
REF      DESCRIPTOR                                  CITATIONS REL.   TERMS REF
E1    IT/INFORMATION CENTERS                                 47            E1
E2    IT/INFORMATION DISSEMINATION                          218            E2
E3    IT/INFORMATION DYNAMICS CORPORATION                     1            E3
E4    IT/INFORMATION NEEDS                                   34            E4
E5    IT/INFORMATION PROCESSING                             104            E5
E6    IT/INFORMATION RETRIEVAL                              119            E6
E7    IT/INFORMATION SCIENCE                                 17            E7
E8    IT/INFORMATION SEEKING                                  4            E8
E9    IT/INFORMATION SERVICES                                34            E9
ENTER NEXT COMMAND>
```

This command is used to view alphabetically near index terms (to the entered term) which appear in the index term dictionary. Note that the entered term in this case is given a reference number of E5. Such displayed terms can be selected by using their associated "E" number (as opposed to re-keying the term).

Command message: DISPLAY "5/2/8"

Result:

```
                                DISPLAY   5/2/8
EDO19094        OCT67     L1000396      NASA-CR-918
 EVALUATION OF USER REACTIONS TO A PROTOTYPE ON-LINE INFORMATION RETRIEVAL SYST
EM.
 MEISTER, DAVID     SULLIVAN, DENNIS J.
 CIQ08350BUNKER-RAMO CORP., CANOGA PARK, CALIF.
 DOCUMENT NOT AVAILABLE FROM EDRS.
 /*INFORMATION RETRIEVAL/*MAN MACHINE SYSTEMS/*USE STUDIES/ AUTOMATION/ COMPUTE
RS/ EVALUATION/ FEEDBACK/ INFORMATION NEEDS/ INFORMATION SYSTEMS/ INTERACTION/ I
NTERVIEWS/ LIBRARIANS/ NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/ QUE
STIONAIRES/ RECON/ SCIENTIFIC PERSONNEL/ TIME SHARING
ENTER NEXT COMMAND►
```

This command is used to view citations from sets (resulting from SELECT or COMBINE commands). The above result indicates the citation is from Set 5, is displayed in format 2, and is the eighth item in the set.

Abstracts for any displayed citation can be displayed by simply depressing the DISPLAY key (and the ENTER key). The following display shows the first page of the abstract corresponding to the first illustrated citation.

```
                                DISPLAY   5/4/8
68A19094
 REACTIONS OF A USER POPULATION (SCIENTISTS/ENGINEERS AND LIBRARIANS) TO AN OPER
ATIONAL TEST OF AN ON-LINE SYSTEM FOR RETRIEVING DOCUMENT CITATIONS (RECON) WERE
 STUDIED AT SEVERAL NASA FACILITIES.  DURING A TWO MONTH OPERATIONAL TEST PERIOD,
 DATA WERE COLLECTED REGARDING FREQUENCY OF USAGE AND DEGREE OF SUCCESS ENCOUNTE
RED IN CONDUCTING ON-LINE SEARCHES.  ADDITIONAL DATA WERE GATHERED BY OBSERVATION
, INTERVIEWS, QUESTIONNAIRES AND CONTROLLED EXPERIMENTAL TESTS CONCERNING THOSE
FEATURES OF THE SYSTEM WHICH WERE MOST ACCEPTABLE TO THE USER POPULATION AND THE
 ADEQUACY WITH WHICH THIS SYSTEM COULD RETRIEVE CITATIONS IN COMPARISON WITH OFF
-LINE MACHINE SEARCH METHODS.  THE USER POPULATION USED THE SYSTEM EXTENSIVELY
ENTER NEXT COMMAND►                                                    -MORE--
```

Section 2
COMMAND DESCRIPTION

- BEGIN SEARCH

  Depressing this key (together with the SHIFT key) will cause a display on the screen requesting the date, the user's name, and the title of the search. The user will type this information in the area provided, depressing the ENTER (shift) key on completion of each item.

- EXPAND term (see page 7 for example)

  Depression of EXPAND and entry of a term cause a display of descriptors that are alphabetically close to the entered term. With each descriptor is shown the number of citations in which the descriptor appears as well as the number of conceptually related terms which are available as descriptors. Each display descriptor is numbered (E1 through E9) and can be referenced by this number (while being displayed) in other EXPAND or SELECT commands. The number of related terms (if any) for any displayed term are shown in the right-hand column of the display. These conceptually related terms may be displayed by depressing EXPAND with the desired E number reference.

- SELECT term (see page 6 for example)

  Terms may be selected either by referencing the E number of an EXPAND display or by entering the term itself. SELECT adds the term so entered to the user's search descriptor list, and makes the set of citations associated with the term more readily available to the computer. A set identification number is assigned by the computer for use in subsequent COMBINE and output commands.

- COMBINE set description (see page 6 for example)

  Depression of this command key, together with entry of a set description, causes the generation of a new set corresponding to the operation specified in the set

description. A set description is a series of set numbers separated by one of the following operator symbols:

Symbol	Operation
+	OR
*	AND
-	NOT

The set description 1+2+3 means that any citation containing index term 1 or term 2 or term 3 will be returned. This operator symbol is used to broaden the scope of a search by grouping similar terms such as "defect or flaw or porosity." The set description 1*2*3 means that any citation retrieved must contain all of the terms 1 and 2 and 3. This operator is used to narrow the scope of a search by requiring the common occurrence of several index terms such as "WELD and DEFECT and ALUMINUM." By using the results of one COMBINE command in the definition of another, sets such as (1+2)*(3+4) can be developed. An example of such a set could be that containing (WELD or ARC WELD) and (DEFECT or FLAW). In this case, returned items will contain WELD and DEFECT, WELD and FLAW, ARC WELD and DEFECT, or ARC WELD and FLAW. At the conclusion of each combine command, the computer assigns a set number to the results, indicates the number of entries in the set, and develops an expanded set description in terms of individual subject term set numbers.

Special note: A consecutive string of sets appearing on the console printer may be combined by depressing COMBINE, keying in the range of set numbers to be combined followed by a slash, and keying in the desired operator (+ for "or," * for "and") (e.g., sets 1 through 5 can be OR'd by COMBINE 1-5/+).

- LIMIT set/yr/type/range

This command, although generally not applicable to the ERIC file, can be used to limit sets to certain specified accession number ranges. To limit Set 5 to the range ED010000–ED015000, for example, it is necessary to enter:

LIMIT "5/ALL/ALL/10000-15000"

If it is desired to limit all subsequent sets in a similar manner, it is necessary to enter:

LIMIT "ALL/ALL/ALL/10000-15000"

- KEEP set/item

  set is the set identification number appearing on the console typewriter

  item may either be a single number (e.g., 3), a range of numbers (e.g., 5-9), or the word ALL indicating which items in a set are to be kept. If "item" is not specified, ALL is assumed by the computer. To keep an item currently being displayed, it is merely necessary to depress KEEP (and ENTER).

  The results of this command are placed in a set arbitrarily numbered 99. Set 99 may be displayed, printed, or combined with other sets.

- DISPLAY set/fmt/item

- TYPE set/fmt/item

- PRINT set/fmt/item

  set is a set identification number which appears on the console typewriter

  fmt is any one of three format codes requested: e.g., 1 (accession numbers); 2 (formatted citations); 3 (full citation, unformatted); 4 (abstract); 5 (formatted citation and abstract).

  item may either be a single number (e.g., 3), a range of numbers (e.g., 5-9), or the word ALL indicating which items in a citation set are to be output. If "item" is not specified, ALL is assumed by the computer.

DISPLAY (see page 7 for example): The citation(s) requested are displayed on the video console by depressing this command key, entering the desired set/fmt/item, and depressing ENTER. If a range of citations is requested, successive citations are displayed by depressing ENTER to change the display. The abstract for any displayed citation (format 2) can be displayed by depressing DISPLAY (and ENTER). This operation does not interrupt the normal sequencing of a previous DISPLAY command.

TYPE: The citations indicated are typed out on the typewriter whenever this command key is depressed. This command should not be depressed until the search is complete.

PRINT: Citations are printed off-line and delivered to the Clearinghouse the next day.

TYPE or PRINT (and ENTER) can be used to output any displayed citation immediately. A display sequence is not interrupted by this operation.

Special note: If format 2 and all items of a set are desired in an output command (DISPLAY, TYPE, PRINT) it is necessary only to enter the command and the set number (e.g., DISPLAY 5 is equivalent to DISPLAY 5/2/ALL).

- END SEARCH

  This command terminates the search, and requests comments from the user. Depression of the final ENTER key (after comments have been entered) clears the computer for the next search.

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Section 3

ERIC/DIALOG DESCRIPTOR CODES AND EXAMPLES

This section presents descriptor codes and examples. The citation display for EDO13371 is shown. This is the same citation shown and described in the front matter of recent issues of Research in Education (Fig. 5). The descriptor code examples are taken from this citation.

```
                                DISPLAY   EDO13371/2
EDO13371    15APR66     64     AA000223     NDEA-7B-449     OEC-4-16-023
  ICONIC SIGNS AND SYMBOLS IN AUDIOVISUAL COMMUNICATION, AN ANALYTICAL SURVEY OF
 SELECTED WRITINGS AND RESEARCH FINDINGS.  FINAL REPORT.
  NORBERG, KENNETH D.
  CIQ77250SACRAMENTO STATE COLL., CALIF.
  EDRS PRICE  MF-$0.75  HC-$5.24    131P.
  /*BIBLIOGRAPHIES/*COMMUNICATION (THOUGHT TRANSFER)/*PERCEPTION/*PICTORIAL STIM
ULI/*SYMBOLIC LANGUAGE/ INSTRUCTIONAL TECHNOLOGY/ VISUAL STIMULI
```

Code	Example	Description
AC/	AC/64	Area Code – Code for O. E. legislative program which supported research activity
AU/	AU/NORBERG, KENNETH D.	Author of document
CN/	CN/OEC-4-16-023	Contract Number
DN/	DN/NDEA-VIIB-449	Document Number – Assigned by originator of document
IT/	IT/BIBLIOGRAPHIES (etc.)	Index Terms – Subject terms assigned by an indexer to characterize document contents
PS/	PS/SACRAMENTO STATE COLL., CALIF.	Primary Source – Organization at which document originated
SC/	SC/CIQ77250	Source Code – Code number for originating organization
TI/	TI/ICON IC SIGNS AND SYMBOLS...	Title – The first 47 characters of the title
YR/	YR/66	Year – Publication year of document

These descriptor type codes are included in an index listing of the ERIC/DIALOG retrieval index which is available at the terminal.

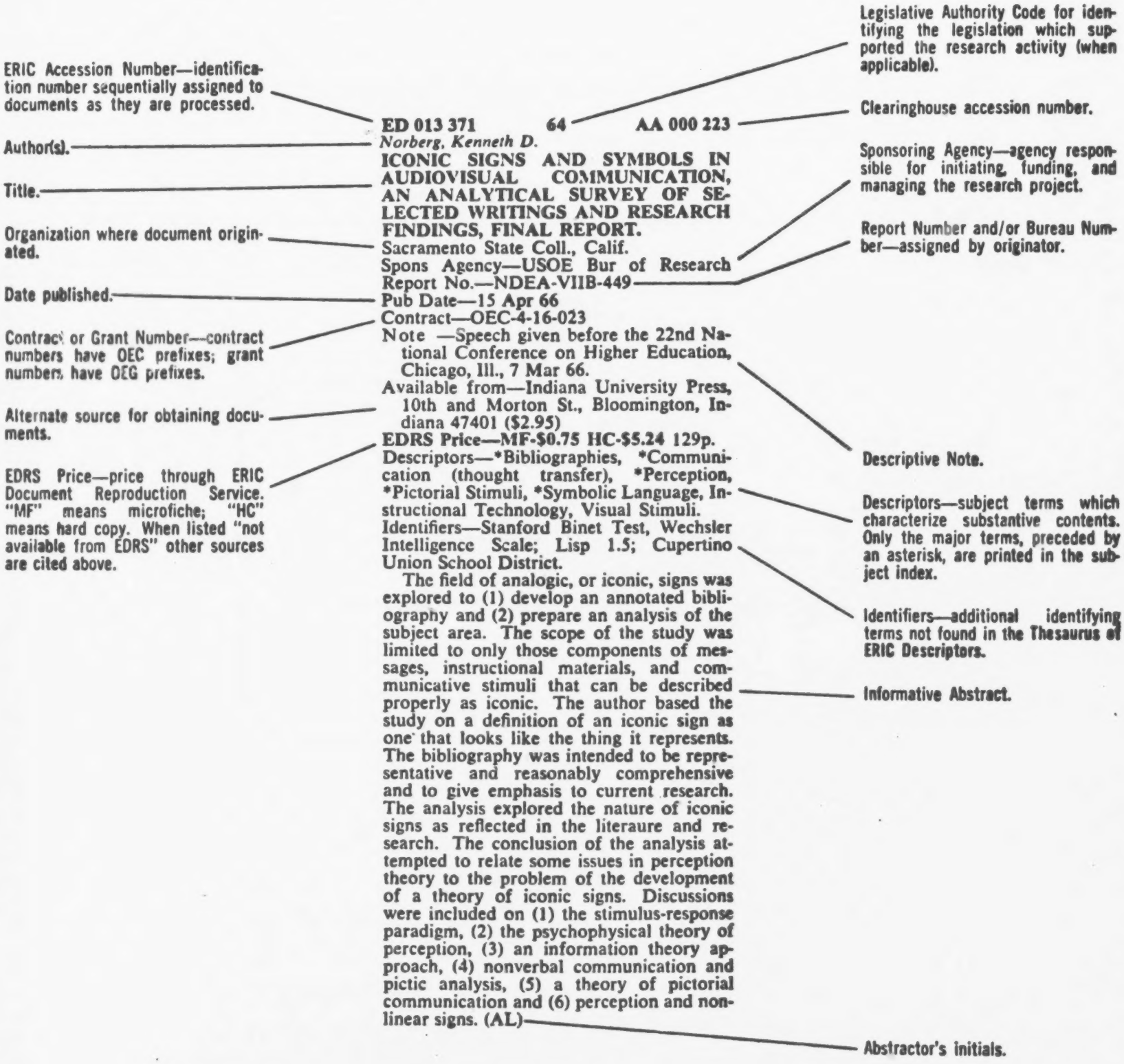
ERIC Accession Number—identification number sequentially assigned to documents as they are processed.
Author(s).
Title.
Organization where document originated.
Date published.
Contract or Grant Number—contract numbers have OEC prefixes; grant numbers have OEG prefixes.
Alternate source for obtaining documents.
EDRS Price—price through ERIC Document Reproduction Service. "MF" means microfiche; "HC" means hard copy. When listed "not available from EDRS" other sources are cited above.
Legislative Authority Code for identifying the legislation which supported the research activity (when applicable).
Clearinghouse accession number.
Sponsoring Agency—agency responsible for initiating, funding, and managing the research project.
Report Number and/or Bureau Number—assigned by originator.
Descriptive Note.
Descriptors—subject terms which characterize substantive contents. Only the major terms, preceded by an asterisk, are printed in the subject index.
Identifiers—additional identifying terms not found in the Thesaurus of ERIC Descriptors.
Informative Abstract.
Abstractor's initials.
ED 013 371 64 AA 000 223
Norberg, Kenneth D.
ICONIC SIGNS AND SYMBOLS IN AUDIOVISUAL COMMUNICATION, AN ANALYTICAL SURVEY OF SELECTED WRITINGS AND RESEARCH FINDINGS, FINAL REPORT.
Sacramento State Coll., Calif.
Spons Agency—USOE Bur of Research
Report No.—NDEA-VIIB-449
Pub Date—15 Apr 66
Contract—OEC-4-16-023
Note —Speech given before the 22nd National Conference on Higher Education, Chicago, Ill., 7 Mar 66.
Available from—Indiana University Press, 10th and Morton St., Bloomington, Indiana 47401 ($2.95)
EDRS Price—MF-$0.75 HC-$5.24 129p.
Descriptors—*Bibliographies, *Communication (thought transfer), *Perception, *Pictorial Stimuli, *Symbolic Language, Instructional Technology, Visual Stimuli.
Identifiers—Stanford Binet Test, Wechsler Intelligence Scale; Lisp 1.5; Cupertino Union School District.
The field of analogic, or iconic, signs was explored to (1) develop an annotated bibliography and (2) prepare an analysis of the subject area. The scope of the study was limited to only those components of messages, instructional materials, and communicative stimuli that can be described properly as iconic. The author based the study on a definition of an iconic sign as one that looks like the thing it represents. The bibliography was intended to be representative and reasonably comprehensive and to give emphasis to current research. The analysis explored the nature of iconic signs as reflected in the literaure and research. The conclusion of the analysis attempted to relate some issues in perception theory to the problem of the development of a theory of iconic signs. Discussions were included on (1) the stimulus-response paradigm, (2) the psychophysical theory of perception, (3) an information theory approach, (4) nonverbal communication and pictic analysis, (5) a theory of pictorial communication and (6) perception and nonlinear signs. (AL)

Fig. 5 Sample Entry (Extracted From Research in Education, Feb 1969)

Appendix B

EXAMPLES OF INVITATION LETTERS SENT OUT FROM SEARCH CENTERS

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

INSTITUTE FOR COMMUNICATION RESEARCH
ERIC Clearinghouse on Educational Media and Technology

CYPRESS HALL
(415) 321-2300
Extension 3081

March 14, 1969

Dear Colleague in Education:

You are invited to see "ERIC On Line," at the Stanford ERIC Clearinghouse. Thanks to an advanced computer system developed by the Lockheed Missiles and Space Company, the citations and abstracts of more than 15,000 documents in the ERIC system can be searched in seconds, viewed on a cathode-ray display console, and printed for permanent reference.

The system permits fast, simple interaction between user and computer. The user types in index terms, authors, or titles of interest to him. He may use many terms in combination (e.g., "televised instruction" or "educational television" and "disadvantaged youth" or "disadvantaged groups"); this is a powerful information retrieval strategy that is not possible in printed, noncomputerized indexes. When the user has inspected the documents that meet his search request, he can select and combine documents into a "relevant set" for printing. If the search has not identified as many documents as he needs or expects to see, he can expand his request, view more citations on the cathode-ray display, and enlarge his "relevant set." The system will also display lists of authors with similar names or lists of similar index terms, if the user needs such assistance in forming his search request.

Educators and researchers who have already visited our Clearinghouse to see "ERIC On Line" are very pleased with its performance. They share our hope that a system like this will eventually connect local information centers, and even individual schools, in a national on-line educational information system.

At the present time, "ERIC On Line" operates Tuesdays, Wednesdays and Fridays. We have demonstration hours scheduled from 1 to 2 PM on those days. The system will be operating at least until the end of the summer.

If you can, please stop by and see us. Bring your own search request so that we can find out how well the system serves your needs. It would help us, in scheduling our own use of the computer, to know when you are coming.

William Paisley
Director

OFFICE OF EDUCATION

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE
760 MARKET STREET, ROOM 837
SAN FRANCISCO, CALIFORNIA 94102

December 29, 1969

Dear Colleague in Education:

On August 21, 1969, we sent letters to almost two hundred educational administrators and decision makers, inviting them to observe and to use the ERIC/DIALOG ON-LINE RETRIEVAL SYSTEM in our Regional Office quarters in San Francisco. Most of the addressees were located in the metropolitan San Francisco area.

Our August letter explained that "ERIC On-Line" was an experiment scheduled for public use from September 2 through October 31, 1969. We are now happy to announce that this experimental operation has been extended through July 15, 1970, by decision of the Office of Information Dissemination, U. S. Office of Education, Washington, D. C. The USOE decision was prompted in large part by the extensive and generally very favorable response of the many educators who were able to take advantage of our first invitation.

At this time, we are not only repeating our invitation for the benefit of those individuals who could not be accommodated by the previous tight scheduling, but we are also further encouraging the use of "ERIC On-Line" by educational researchers. The latter group had access to an "ERIC On-Line" facility which had been operated by the ERIC Clearinghouse on Educational Media and Technology, at Stanford University. Thus, for the time being, we are the only USOE Regional Office carrying on the further experimental use of an "ERIC On-Line" retrieval system.

Although it is just possible that two additional hours per week for using "ERIC On-Line" may be available, our firm schedule is: Tuesdays, Wednesdays and Fridays, from 1:00 p.m. to 3:00 p.m.

If you can, please drop in to see the "ERIC On-Line" system in operation. Better yet, please bring your own search request so that we can continue to analyze how well the system serves your needs. To expedite your search, please phone us in advance (Mrs. Katherine Alderfer, at 415-556-8986) so that we can schedule your visit within the limited time available. A

member of our staff will be on duty to assist you in every possible way in your dialog with "ERIC On-Line." And to make our service even more efficient, we ask that you take a minute or two now to complete the attached one-page "Pre-Dialog" questionnaire and present it to us when you come to our office for a specific information search.

In conclusion, a brief description of "ERIC On-Line" is still considered appropriate, even though it was described in our letter of August 21, 1969. The "ERIC On-Line" is an advanced computer system developed by Lockheed Missiles and Space Company. Through this system, the citations and abstracts of approximately 25,000 documents in the ERIC collection of educational research documents can be searched in seconds, viewed on a cathode-ray display console, and printed for permanent reference.

The system permits fast, simple interaction between user and computer. The user types the index terms, authors, or titles of interest to him. He may use many terms in combination (e.g., "televised instruction" or "educational television" and "disadvantaged youth" or "disadvantaged groups"). This is a powerful information retrieval strategy that is not possible in printed, noncomputerized indexes. When the user has inspected the documents that meet his search request, he can select and combine documents into a "relevant set" for printing. If the search has not identified as many documents as he needs or expects to see, he can expand his request, view more citations on the cathode-ray display, and enlarge his "relevant set." The system will also display lists of authors with similar names or lists of similar index terms, if the user needs such assistance in forming his search request.

Sincerely yours,

Walter Hirsch

Walter Hirsch
Director, Educational Research
Region 9

Attachment

ERIC PRE-DIALOG QUESTIONNAIRE - Region 9, USOE

me: _____
Address: _____
Telephone: _____
Agency or Institution: _____
Your title or job: _____
Date: _____

1. Please describe briefly the information you will be looking for in the ERIC files:

2. About how many documents do you expect to find in the ERIC file on this topic? (PLEASE CIRCLE ONE)

   Less than 10 10-25 26-50 51-100 More than 100

3. Have you ever used the ERIC publication, RESEARCH IN EDUCATION? YES NO

4. (If Yes:) Have you searched RIE by subject? YES NO

   Have you searched RIE by title? YES NO

   Have you searched RIE by author? YES NO

   Have you chosen any terms from the ERIC THESAURUS to begin your search? YES NO

   (If YES:) Please list the principal ones:

6. How familiar are you with on-line retrieval systems? (PLEASE CHECK EACH ANSWER THAT APPLIES)
   - ( ) I've heard about them
   - ( ) I've read about them
   - ( ) I've studied them in some detail
   - ( ) I've designed or cooperated in the design of an on-line system
   - ( ) None of the above

7. How much experience with DIALOG have you had? (PLEASE CHECK EACH ANSWER THAT APPLIES)
   - ( ) I have previously used DIALOG myself, sitting at the console
   - ( ) I have watched another person use DIALOG
   - ( ) I have had no previous experience with DIALOG

8. How much experience have you had with on-line retrieval systems other than DIALOG? (PLEASE CHECK THE ANSWER THAT BEST APPLIES)
   - ( ) I have used several systems, each on more than one occasion
   - ( ) I have used several systems, each on one occasion
   - ( ) I have used one system on more than one occasion
   - ( ) I have used one system on one occasion
   - ( ) I have watched others using system(s)
   - ( ) I have had no previous experience with on-line systems

Appendix C

DETAILED SUMMARY OF SEARCH RESULTS AND COMPARATIVE EVALUATION OF EQUIPMENT

Appendix C provides frequency distributions summarizing system use. The distributions are recorded for Stanford, San Francisco, and a conference at San Diego. Also included in this appendix is a sample listing of search titles to acquaint the reader with the variety of questions asked of the system. Finally, a detailed description and comparison of the different equipment used is presented.

Usage Statics

Usage statistics are gathered automatically by the DIALOG system. Tabulation, however, is manual. To obtain the data shown in the tables in this appendix, samples of 100 search histories were taken from Stanford and from San Francisco. A sample of 25 searches was used from the San Diego conference.

Usage is described according to elapsed time per search session (which may include several search questions), online references to the Thesaurus, number of index terms selected per search session, number of concept groups per search expression, number of clerical errors per session, number of abstracts displayed, and number of abstracts printed.

Table C-1 shows the distributions of elapsed search time per search session. It should be realized that a search session frequently included several (usually related) search questions. Furthermore, sessions, were often used for instruction of unfamiliar users.

The high average time at Stanford resulted from a high incidence of demonstration and instruction sessions. The low average time at San Diego reflects an attempt to demonstrate the system to as many people as possible consistent with producing a reasonably inclusive bibliography.

Table C-2 indicates the number of Thesaurus references made by computer. The Thesaurus is referenced to assist the user in finding descriptors (index terms) that are appropriate to a particular search question. Generally, the more familiar one is with the collection, the less frequently this command is used. Some users prereference the printed ERIC Thesaurus, which also reduces the necessity for online use.

Few, if any, retrieval systems (other than DIALOG) provide online access to the Thesaurus. As indicated in Table C-2, this feature is heavily used, when available.

Table C-1

ELAPSED SEARCH TIME

Search Time (min)	Percent of Searches		
	Stanford	San Francisco	San Diego
0 – 10	28.0	21.0	8.0
11 – 20	24.0	45.0	36.0
21 – 30	16.0	17.0	32.0
31 – 40	12.0	11.0	12.0
41 – 50	8.0	2.0	8.0
51 – 60	4.0	1.0	4.0
61 – 70	8.0	3.0	0.0
Average Time per Search	23.7	19.8	16.3

Table C-2

NUMBER OF THESAURUS REFERENCES PER SEARCH SESSION

Number of References per Session	Percent of Searches		
	Stanford	San Francisco	San Diego
0	25.0	10.0	0.0
1 – 5	39.0	22.0	20.0
6 – 10	19.0	29.0	56.0
11 – 15	12.0	24.0	12.0
16 – 20	6.0	6.0	8.0
21 – 25	2.0	5.0	4.0
26 – 30	1.0	3.0	0.0
31 – 35	1.0	0.0	0.0
36 – 40	0.0	1.0	0.0
Average Thesaurus References	6.4	9.5	8.9

Table C-3 depicts the number of terms per search session. This measure indicates the number of different descriptors selected by the user in the course of developing his search question(s). This measure is indicative of the power of a coordinate retrieval system in that it is generally not feasible to accomplish unions and intersections of sets of abstracts in manual systems.

Table C-3

NUMBER OF INDEX TERMS SELECTED PER SEARCH SESSION

Number of Index Terms Selected	Percent of Searches		
	Stanford	San Francisco	San Diego
1 – 10	46.0	29.0	36.0
11 – 20	35.0	40.0	40.0
21 – 30	8.0	9.0	16.0
31 – 40	8.0	9.0	8.0
41 – 50	1.0	5.0	0.0
51 – 60	0.0	3.0	0.0
61 – 70	0.0	2.0	0.0
71 – 80	1.0	0.0	0.0
81 – 90	0.0	2.0	0.0
91 – 100	1.0	1.0	0.0
Average Index Terms per Search	15.0	21.9	15.1

Table C-4 shows a distribution of abstracts displayed per search. The display of abstracts allows the user to evaluate the relevance of items retrieved for particular search expressions. Normally, the more items displayed, the higher the relevance of the final output, and the fewer the number of items printed.

Table C-4

NUMBER OF ABSTRACTS DISPLAYED PER SEARCH SESSION

Number of Abstracts Displayed	Percent of Searches		
	Stanford	San Francisco	San Diego
0	57.0	16.0	8.0
1 – 5	21.0	46.0	32.0
6 – 10	10.0	21.0	36.0
11 – 15	6.0	10.0	16.0
16 – 20	3.0	6.0	
21 – 25	3.0	1.0	
Average Number of Abstracts Displayed	3.4	5.8	5.9

Table C-5 is a distribution of the number of items printed per search session. The printed output usually consists of a printout of both bibliographic citations (title, author, subject items, etc.) and descriptive abstracts. This is the final product of the search and represents a special bibliography developed at the remote terminal to answer a particular question.

Table C-5

NUMBER OF CITATIONS AND ABSTRACTS PRINTED PER SEARCH SESSION

Number of Citations and Abstracts Printed	Percent of Searches		
	Stanford	San Francisco	San Diego
0	9	0	8
1 – 20	31	34	28
21 – 40	11	25	32
41 – 60	7	22	28
61 – 80	8	7	1
81 – 100	6	4	1
101 – 120	4	2	1
121 – 140	2	0	1
141 – 160	4	2	
161 – 180	2	1	
181 – 200	1	0	
Over 200	5	3	
Average Number of Items Printed	91.7	44.3	30.4

Sample Search Topics

The following topics are examples of the kinds of inquiries that may be addressed to the system:

Instructional terms
Student activism
Research in literature
Educational parks and laboratories
Research and Development Centers
Drug abuse
Innovations in curricula
High school guidance
Ecology and conservation education
Vocational counseling and career planning
Optic chiasma
Supervision of student teachers
Changing attitudes toward race problems
Discrimination toward females

Student attitudes toward teacher behavior
Creative programs for infants
Black studies
Diffusion of innovations
History of educational technology
Instructional materials for handicapped children
Multi-cultural education
Individual instruction projects
Evaluation of educational media
Social studies and the disadvantaged
Utilization of educational technology
Production of instructional materials
Generally useful skills for job placement
Use of computers in higher education
Suicide among college students
Large-group instruction
Programed instruction for the deaf
Selection of library materials
Use of simulation and gaming techniques
Cost effectiveness in school administration

Evaluation of Equipment

The Stanford facility used an IBM 2260 terminal that operated at 2400 bits/sec (240 characters/sec) over a Bell Systems 201B data set. Both the San Francisco and Washington facilities used a Computer Communications, Inc. (CCI) CC30 terminal. Table C-6 provides a comparison of pertinent terminal characteristics.

Table C-6

COMPARISON OF TERMINAL CHARACTERISTICS AND COSTS

Item	Characteristics and Costs	
	IBM 2260	CC30
Screen Size (Characters)	960 ch.	960 ch.
Transmission Speed	240 ch./sec	120 ch./sec
Telephone Modems	201B	202D
Modem Rental per Month	$85.00	$45.00
Terminal Rental per Month	$705.00	$323.00

In addition to the above characteristics, the IBM terminal requires 220-V current, air conditioning, and a dedicated, leased telephone line. There was slightly higher reliability with this configuration, however, than with the CCI terminal, which utilizes ordinary dial-up telephone lines (n.b., the CC30 terminal can be configured with the more reliable telephone lines). The latter terminal uses standard 100-V current, requires no air conditioning, and is portable.

User reaction to both terminals was uniformly favorable with regard to display format, ease of viewing, and keyboard operation.

An experimental evaluation was conducted utilizing a computer-controlled microfilm display device manufactured by MicroForm Data Systems. In this mode of operation, the user communicates his search strategy to the computer through an ordinary teletype or typewriter terminal. Instead of the computer returning the full text of the retrieved abstracts to the terminal, it merely sends back addresses of retrieved abstracts to the microfilm display device. Each of the addresses positions selected abstracts, contained on microfilm, for display on the microfilm display.

Although the microfilm device was operational by the end of the experimental period, the images were of less than satisfactory viewing quality, and the positioning mechanism was somewhat unreliable. It is felt that image quality could be improved somewhat by producing the films directly from the abstract computer tapes (rather than optically refilming the images as was actually done). This configuration was demonstrated at the 1969 Fall Joint Computer Conference at Las Vegas.